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EXAMINER	
THOMPSON, JAMES A	
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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No. 09/671,393	Applicant(s) SHARMA ET AL.	
	Examiner James A Thompson	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 06 August 2004.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) _____ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-23 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 20 July 2001 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed 06 August 2004 have been fully considered but they are not persuasive.

Examiner is not solely relying upon Knox to anticipate the claimed invention. Matsuda (US Patent 5,677,776) teaches reading a document that has a front page, a back page, and an adjacent page, as clearly set forth on page 2 of the first office action, dated 30 April 2004. Knox (US Patent 5,646,744) teaches show-through compensation of a front side and a back side, as discussed on page 3, line 13 to page 4, line 3 of said first office action. Show-through compensation as taught by Knox is combined with Matsuda to teach show-through compensation *for the front side and back side*, as clearly discussed on page 4, lines 4-11 of said first action. The density data and absorbency data are calculated for the front side and back side through the calculation of P(x), Q(x), A(x), B(x) and f, which is shown in column 6, lines 61-67 of Knox, as cited in said first office action. The deficiency of Matsuda in view of Knox is remedied by the application of Balanis (*Advanced Engineering Electromagnetics*, by Constantine A. Balanis, John Wiley & Sons, ©1989), which clearly shows how to calculate reflections from multiple layers, as discussed on page 4, line 17 to page 5, line 5 of said first office action. Examiner has *not* suggested that Knox teaches show-through compensation for a front side, a back side, and an adjacent side in a set documents that are read. Examiner has clearly demonstrated on page 5, lines 6-17 of said first office action that the teachings of Knox in further view of Balanis, when combined with the primary teaching of Matsuda,

teach show-through compensation for a front side, a back side, and an adjacent side in a set of documents that are read.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-3, 12-13 and 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda (US Patent 5,677,776) in view of Knox (US Patent 5,646,744) and Balanis (*Advanced Engineering Electromagnetics*, by Constantine A. Balanis, John Wiley & Sons, copyright 1989).

Claims 1, 12 and 22 are discussed together. The apparatus of claim 12 performs the method of claim 1. All of the elements of claim 22 are recited in claim 12.

Regarding claims 1, 12 and 22: Matsuda discloses an apparatus (figure 1 of Matsuda) comprising an input/output interface (figure 1(2) and column 4, lines 51-53 of Matsuda). Said input/output interface reads images scanned from a book (figure 6 of Matsuda), which would inherently include, while reading, a front page, a back page, and a plurality of other pages including an adjacent page.

Said apparatus further comprises a memory (figure 20(29) and column 6, lines 47-49 of Matsuda). Figure 20 shows further

details of the construction of said apparatus (column 3, lines 56-57 of Matsuda).

Said apparatus further comprises an image processing circuit (figure 20(30) and column 3, lines 57-58 of Matsuda) for correcting scanned image data (column 9, lines 41-44 of Matsuda).

Matsuda does not disclose expressly that said apparatus comprises a show-through image information compensation device wherein image data for the front side image, the back side image, and the adjacent side image is received through the input/output interface and stored in the memory, and the show-through compensation device determines scanned density data for the front-side and approximate absorbency data for the combination of the back and adjacent side images from received image data for the front side image, the back side image, and the adjacent side image and determines show-through compensated density data for the front side image based on the scanned density data and the approximate absorbency data.

Knox discloses a show-through image information compensation device (figure 4(200) and column 5, lines 44-48 of Knox) wherein image data for the front side image (figure 5B(Side A) of Knox) and the back side image (figure 5B(Side B) of Knox) is received (column 6, lines 4-6 of Knox) through the input/output interface (figure 4(208) and column 5, lines 50-54 of Knox) and stored in the memory (figure 4(204) and column 5, lines 45-46 of Knox) (column 6, lines 4-10 of Knox). Said show-through compensation device determines scanned density data for the front side image (column 5, lines 62-66 of Knox) and approximate absorbency data for the back side image (column 6, lines 37-43 of Knox) from received image data for the front side

image and the back side image that shows through the image bearing substrate (column 6, lines 55-60 of Knox). Said show-through compensation device determines show-through compensated density data for the front side image based on the scanned density data and approximate absorbency data (column 6, lines 61-67 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform show-through compensation as taught by Knox for the document images read by the image reader and processor taught by Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox does not disclose expressly that image data for the adjacent side is received through the input/output interface and stored in memory; and the show-through compensation device determines approximate absorbency data for the combination of the back and adjacent side images from received image data for the back side image and the adjacent side image.

Balanis discloses calculating reflection coefficients for multiple layers (figure 5-20 and page 229, lines 19-24 of Balanis). Equations are given for the reflection coefficients of each individual layer (page 230, lines 6-12 of Balanis) and the equivalent reflection coefficient for all of the layers (page 230, lines 1-4 of Balanis) at the plane of incidence (see Γ_{in} in figure 5-20 of Balanis). The equivalent reflection

coefficient (Γ_{in}) clearly shows that reflection level directly measured at the plane of incidence can represent the multiple reflections from each of the multiple layers (page 229, lines 22-24 of Balanis). The layers can be any form of lossy or lossless dielectric layer (figure 5-20 of Balanis), such as a piece of paper. The reflection coefficients are defined as a function of frequency (page 230, lines 32-35 of Balanis), which inherently covers the electromagnetic spectrum, including optical frequencies.

Matsuda in view of Knox is combinable with Balanis because they are from the same field of endeavor, namely the calculation of reflection data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the reflections from the adjacent page, said reflections further including an equivalent reflection for the pages beneath said adjacent page as taught by Balanis, and use the image data obtained from said reflections of said adjacent page taught by Matsuda as part of the show-through image correction taught by Knox. The motivation for doing so would have been that the reflections from the adjacent page and the pages beneath said adjacent page are significant when correcting for images on a book reader (figure 5-20 and page 230, lines 1-4 of Balanis). Therefore, it would have been obvious to combine Balanis with Matsuda in view of Knox to obtain the invention as specified in claims 1, 12 and 22.

Regarding claim 2: Matsuda does not disclose expressly transforming the show-through compensated density data for one or all of the images into show-through compensated reflectance image data.

Knox discloses transforming the show-through compensated density data for one or all of the images (column 6, lines 54-60 of Knox) into show-through compensated reflectance image data (column 6, lines 61-67 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform show-through compensation as taught by Knox for the document images read by the image reader and processor taught by Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda to obtain the invention as specified in claim 2.

Regarding claim 3: Matsuda does not disclose expressly spatially filtering the effective absorbency data for at least one of the back or adjacent images; and subtracting the spatially filtered absorbency data from the scanned density data for the front side image.

Knox discloses spatially filtering the effective absorbency data for at least one of the back or adjacent images (column 6, lines 41-44 of Knox); and subtracting the spatially filtered absorbency data from the scanned density data for the front side image (column 6, lines 61-67 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform show-through compensation as taught by Knox for the document

images read by the image reader and processor taught by Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda to obtain the invention as specified in claim 3.

Regarding claim 13: Matsuda discloses acquiring image data (column 4, lines 32-35 of Matsuda) from a book (figure 6 of Matsuda), which would inherently include, while reading, a front page, a back page, and a plurality of other pages including an adjacent page.

Matsuda does not disclose expressly a data alignment circuit for aligning image data of the front, back and adjacent side images.

Knox discloses a data alignment circuit for aligning image data of the front and back sides (column 6, lines 46-48 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to align image data, as taught by Knox, said image data being the front, back and adjacent side images taught by Matsuda. The motivation for doing so would have been so that the pixel locations are properly aligned for show-through correction (column 6, lines 47-52 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda to obtain the invention as specified in claim 13.

Regarding claim 23: Matsuda discloses obtaining image data generated by scanning a document (column 4, lines 30-34 of

Matsuda), specifically a book (figure 6 of Matsuda), which would inherently include, while reading, a front page, a back page, and a plurality of other pages including an adjacent page. Matsuda further discloses that the front side image data (figure 6 of Matsuda) is in density space (column 8, lines 60-66 of Matsuda).

Matsuda does not disclose expressly that the show-through compensation is based on a linearized relationship between the scanned data for the front, back and adjacent side images behind the front and back sides.

Knox discloses removing show-through image information from image data (column 6, lines 4-6 of Knox) generated by scanning a duplex printed document (column 6, lines 6-7 of Knox), wherein the show-through compensation is based on a linearized relationship between the scanned data for the front and back side images (column 6, lines 55-64 of Knox). The equations showing the show-through correction (column 6, lines 55-64 of Knox) clearly have a linearized relationship.

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to perform show-through compensation as taught by Knox for the document images read by the image reader and processor taught by Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox does not disclose expressly using a linearized relationship between the scanned data for the front, back and adjacent side images behind the front and back sides.

Balanis discloses calculating reflection coefficients for multiple layers (figure 5-20 and page 229, lines 19-24 of Balanis). Equations are given for the reflection coefficients of each individual layer (page 230, lines 6-12 of Balanis) and the equivalent reflection coefficient for all of the layers (page 230, lines 1-4 of Balanis) at the plane of incidence (see Γ_{in} in figure 5-20 of Balanis). The equivalent reflection coefficient (Γ_{in}) clearly shows that reflection level directly measured at the plane of incidence can represent the multiple reflections from each of the multiple layers (page 229, lines 22-24 of Balanis).

Matsuda in view of Knox is combinable with Balanis because they are from the same field of endeavor, namely the calculation of reflection data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the reflections from the adjacent side behind the front and back sides in combination with the back side as part of the show-through image correction taught by Knox. The motivation for doing so would have been that the reflections from the adjacent page and the pages beneath said adjacent page are significant when correcting for images on a book reader (figure 5-20 and page 230, lines 1-4 of Balanis). Therefore, it would have been obvious to combine Balanis with Matsuda in view of Knox to obtain the invention as specified in claim 23.

4. Claims 4-7, 11, 14-17 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda (US Patent 5,677,776)

in view of Knox (US Patent 5,646,744), Balanis (*Advanced Engineering Electromagnetics*, by Constantine A. Balanis, John Wiley & Sons, copyright 1989), and Bilgen ("Restoration of Noisy Images Blurred by a Random Point Spread Function", by Mehmet Bilgen and Hsien-Sen Hung, *IEEE International Symposium on Circuits and Systems*, 1-3 May 1990, volume 1, pages 759-762).

Claims 7 and 17 disclose the same limitations and are therefore discussed together. Claims 11 and 21 disclose the same limitations and are therefore discussed together.

Regarding claim 4: Matsuda does not disclose expressly using a filter corresponding to a pre-determined show-through point spread function.

Knox discloses spatially filtering show-through image data (column 6, lines 54-64 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the spatial show-through data filtering of Knox to filter the image data read by the apparatus of Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox and Balanis does not disclose expressly that said filter uses a pre-determined point spread function.

Bilgen discloses using a pre-determined point spread function (page 759, column 2, lines 43-45 of Bilgen).

Matsuda in view of Knox and Balanis is combinable with Bilgen are combinable because they are from the same field of endeavor, namely imaging and data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a pre-determine point spread function, as taught by Bilgen, for the spatial filter. The motivation for doing so would have been to restore the image data that is blurred (page 759, column 2, lines 43-45 of Bilgen). Therefore, it would have been obvious to combine Bilgen with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 4.

Regarding claim 5: Matsuda does not disclose expressly using a filter corresponding to a show-through point spread function estimated from the scanned data for the three sides.

Knox discloses spatially filtering show-through image data (column 6, lines 54-64 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the spatial show-through data filtering of Knox to filter the image data scanned by the apparatus of Matsuda for the three sides. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox and Balanis does not disclose expressly that said show-through filter uses a point spread function estimated from the scanned data.

Bilgen discloses using a point spread function (page 759, column 2, lines 43-45 of Bilgen) estimated from the scanned data (page 759, column 2, line 46 to page 760, column 1, line 1 of Bilgen).

Matsuda in view of Knox and Balanis is combinable with Bilgen are combinable because they are from the same field of endeavor, namely imaging and data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a point spread function estimated from the scanned data, as taught by Bilgen, for the spatial filter. The motivation for doing so would have been to restore the image data that is blurred (page 759, column 2, lines 43-45 of Bilgen). Therefore, it would have been obvious to combine Bilgen with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 5.

Regarding claim 6: Since the spatial filter applies filtering to digital data, it is inherent that said spatial filter is a digital filter.

Regarding claim 14: Matsuda discloses means (figure 3(7) of Matsuda) for determining scanned density data for the front side image from the received image data for the front side image data (column 8, lines 60-66 of Matsuda).

Matsuda further discloses that image data is scanned from a book (figure 6 and column 5, lines 4-8 of Matsuda), which would inherently include, while reading, a front page, a back page, and a plurality of other pages including an adjacent page.

Matsuda does not disclose expressly means for approximating an absorbency of the combination of back and adjacent sides and estimating a show-through point spread function; and means for determining show-through compensated density data for the front

side from the scanned density data, the approximated absorbencies and the estimated show-through point spread function.

Knox discloses means for approximating an absorbency of the back side (column 5, line 63 to column 6, line 3 of Knox) and estimating a show-through function (column 6, lines 55-60 of Knox). Knox further discloses means for determining show-through compensated density data for the front side from the scanned density data (column 6, lines 61-67 of Knox), the approximated absorbencies (column 5, line 63 to column 6, line 3 of Knox), and the estimated show-through function (column 6, lines 55-60 of Knox). A computer workstation (figure 4(200) of Knox) performs the various image processing steps (column 5, lines 44-49 of Knox). Said workstation inherently requires some form of software embodied in some form of computer-readable medium in order to perform the various image processing steps. Therefore, the means for approximating and the means for determining are embodied as portions of software stored on a computer-readable medium and executed by said workstation.

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the spatial show-through data filtering of Knox to filter the image data scanned by the apparatus of Matsuda for the three sides. The motivation for doing so would have been to eliminate the image data that is due to show-through data from the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox does not disclose expressly approximating an absorbency of the combination of back and adjacent sides; and that the show-through function is a point spread function.

Balanis discloses calculating reflection coefficients for multiple layers (figure 5-20 and page 229, lines 19-24 of Balanis). Equations are given for the reflection coefficients of each individual layer (page 230, lines 6-12 of Balanis) and the equivalent reflection coefficient for all of the layers (page 230, lines 1-4 of Balanis) at the plane of incidence (see Γ_{in} in figure 5-20 of Balanis). The equivalent reflection coefficient (Γ_{in}) clearly shows that reflection level directly measured at the plane of incidence can represent the multiple reflections from each of the multiple layers (page 229, lines 22-24 of Balanis).

Matsuda in view of Knox is combinable with Balanis because they are from the same field of endeavor, namely the calculation of reflection data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the reflections from the adjacent side in combination with the back side as part of the show-through image correction taught by Knox. The motivation for doing so would have been that the reflections from the adjacent page and the pages beneath said adjacent page are significant when correcting for images on a book reader (figure 5-20 and page 230, lines 1-4 of Balanis). Therefore, it would have been obvious to combine Balanis with Matsuda in view of Knox.

Matsuda in view of Knox and Balanis does not disclose expressly that the show-through function is a point spread function.

Bilgen discloses using a pre-determined point spread function (page 759, column 2, lines 43-45 of Bilgen).

Matsuda in view of Knox and Balanis is combinable with Bilgen because they are from the same field of endeavor, namely imaging and data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use a pre-determine point spread function, as taught by Bilgen, as the show-through function. The motivation for doing so would have been to restore the image data that is blurred (page 759, column 2, lines 43-45 of Bilgen). Therefore, it would have been obvious to combine Bilgen with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 14.

Regarding claim 15: Matsuda does not disclose expressly that the show-through correction is based on a linearized relationship between the image data for the front, back and adjacent sides.

Knox discloses that the show-through correction is based on a linearized relationship between the image data for the front and back sides (column 6, lines 55-64 of Knox). The equations showing the show-through correction (column 6, lines 55-64 of Knox) clearly have a linearized relationship.

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the linearized relationships for the show-through correction taught by Knox to correct the image data received, as taught by Matsuda. The motivation for doing so would have been to eliminate the image data that is due to show-through data from

the opposite page (column 4, lines 52-57 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Knox does not disclose expressly that the show-through correction is based on a linearized relationship between the image data for the front, back and adjacent sides.

Balanis discloses calculating reflection coefficients for multiple layers (figure 5-20 and page 229, lines 19-24 of Balanis). Equations are given for the reflection coefficients of each individual layer (page 230, lines 6-12 of Balanis) and the equivalent reflection coefficient for all of the layers (page 230, lines 1-4 of Balanis) at the plane of incidence (see Γ_{in} in figure 5-20 of Balanis). The equivalent reflection coefficient (Γ_{in}) clearly shows that reflection level directly measured at the plane of incidence can represent the multiple reflections from each of the multiple layers (page 229, lines 22-24 of Balanis).

Matsuda in view of Knox is combinable with Balanis because they are from the same field of endeavor, namely the calculation of reflection data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the reflections from the adjacent side in the linearized show-through equations. The motivation for doing so would have been that the reflections from the adjacent page and the pages beneath said adjacent page are significant when correcting for images on a book reader (figure 5-20 and page 230, lines 1-4 of Balanis). Therefore, it would have been obvious to combine Balanis with Matsuda in view of Knox to obtain the invention as specified in claim 15.

Further regarding claim 16: Bilgen further discloses that said point spread function is applied as a filter (page 759,

column 1, lines 40-44 of Bilgen). Since the filter is applied to digital data, then said filter is inherently a digital filter.

Further regarding claims 7 and 17: Bilgen further discloses that said digital filter uses an iterative process (page 759, column 1, lines 40-44 of Bilgen) based on the average mean square error (page 761, column 1, lines 2-5 of Bilgen), and is thus an adaptive filter.

Regarding claims 11 and 21: Matsuda does not disclose expressly that the show-through compensated density data is determined using the relationship: $D_1(x,y) = D_1^s(x,y) - H(x,y) * A_{23}^e(x,y)$.

Knox discloses calculating show-through compensated density data (column 6, lines 54-64 of Knox).

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to compensate for show-through density data. The motivation for doing so would have been show-through data is a defect in the obtained image data (column 5, lines 59-61 of Knox) and should therefore be corrected. Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox and Balanis does not disclose expressly that the show-through compensated density data is determined using the relationship: $D_1(x,y) = D_1^s(x,y) - H(x,y) * A_{23}^e(x,y)$.

Bilgen discloses an equation in the frequency domain for determining the compensated density data in terms of the point spread function (page 760, column 2, lines 4-9 of Bilgen). $H(k,l) = \overline{H}(k,l) + \Delta H(k,l)$ is the point spread function (page 759,

column 2, lines 26-28 of Bilgen). The estimated image is given by $F(k,l)$ and its Fourier transform in two dimensions is given by $\hat{F}(k,l)$ (page 760, column 2, lines 61-65 of Bilgen). $G(k,l)$ is the 2-D Fourier transform of the distorted image (page 760, column 2, lines 58-60 of Bilgen). The distortion compensation data ($\Xi(k,l)$) is given by the equation $\Xi(k,l) = G(k,l) - H(k,l)\hat{F}(k,l)$ (page 760, column 2, lines 4-9 of Bilgen). Since the equation is given in the frequency domain (page 760, column 2, lines 7-8 of Bilgen), the equivalent form of the equation in the spatial domain would given by the equation $\Xi(x,y) = G(x,y) - H(x,y) * F(x,y)$, where (*) represents convolution. It is well known in the art that, when an equation is transformed from the Fourier domain to the spatial domain, the Fourier transformed variables are replaced with their corresponding spatially-dependent variables and multiplication is replaced with convolution. The equation for $\Xi(k,l)$ is the same as the equation $D_1(x,y) = D_1^s(x,y) - H(x,y) * A_{23}^e(x,y)$ since the variables representing the same quantities correspond to each other.

Matsuda in view of Knox and Balanis is combinable with Bilgen because they are from the same field of endeavor, namely imaging and data processing. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the image correction equation of Bilgen to compensate for the density data. The motivation for doing so would have been to correct image defects (column 5, lines 59-61 of Knox). Therefore, it would have been obvious to combine Bilgen with Matsuda in view of Knox and Balanis to obtain the invention as specified in claims 11 and 21.

5. Claims 8-10 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda (US Patent 5,677,776) in view of Knox (US Patent 5,646,744), Balanis (*Advanced Engineering Electromagnetics*, by Constantine A. Balanis, John Wiley & Sons, copyright 1989), and Numakura (US Patent 5,371,616).

Claims 10 and 20 disclose the same limitations and are therefore discussed together.

Regarding claim 8: Matsuda discloses scanning the density of the front side (column 5, lines 4-9 of Matsuda).

Matsuda in view of Knox and Balanis does not disclose expressly determining a logarithm (or approximation thereof) of the ratio of the received image data for a region of the image bearing substrate containing an image and for a region of the image having no image on either the front or back sides.

Numakura discloses determining a logarithm (or approximation thereof) of the ratio of the received image data for a region of the image bearing substrate containing an image (I) and for a region of the image having no image on either the front or back sides (I_0) (column 9, lines 44-53 of Numakura). In order for the reference light intensity value (I_0) to be the same as the incident light intensity, it is inherent that there can be no image on either the front or back sides of the reference region.

Matsuda in view of Knox and Balanis is combinable with Numakura because they are from the same field of endeavor, namely the computation of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the relationship taught by Numakura to determine the scanned density data. The motivation for doing so would have been that said determination is needed for the

purpose of halftoning the image data (column 9, lines 41-43 of Numakura). Therefore, it would have been obvious to combine Numakura with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 8.

Regarding claim 9: Matsuda discloses scanning the density of the front side (column 5, lines 4-9 of Matsuda).

Matsuda in view of Knox and Balanis does not disclose expressly that the scanned density of the front side is determined using the relationship: $D_1^s(x,y) = -\ln\left(R_1^s(x,y) / R_p^w \right)$ where ln() denotes the natural logarithm.

Numakura discloses that the relationship between the density value and the reflectance value is given by the relationship $D = \log(I_0 / I)$ where I_0 is the incident light intensity and I is the reflected light intensity (column 9, lines 44-53 of Numakura). The equation can also be written as $D = -\log(I / I_0)$. $R_1^s(x,y)$ corresponds to I since both are the reflected light intensity and $D_1^s(x,y)$ is the corresponding density. R_p^w is the reference reflectance value and therefore corresponds to the value I_0. Numakura uses a base-10 logarithm instead of a natural logarithm, but this is a simple design choice since the difference between a natural log and a base-10 log is the factor $\log_{10}(e)$. The use of a natural logarithm as opposed to a base-10 logarithm simply changes the range of density values.

Matsuda in view of Knox and Balanis is combinable with Numakura because they are from the same field of endeavor, namely the computation of image data. At the time of the invention, it would have been obvious to a person of ordinary

skill in the art to use the relationship taught by Numakura to determine the density of the front side. The motivation for doing so would have been that said conversion is needed for the purpose of halftoning the image data (column 9, lines 41-43 of Numakura). Therefore, it would have been obvious to combine Numakura with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 9.

Regarding claims 10 and 20: Matsuda discloses scanning the density of the front side (column 5, lines 4-9 of Matsuda), of a book (figure 6 of Matsuda). Since books are comprised of a plurality of pages, said book would inherently include, while acquiring said data, a front page, a back page, and a plurality of other pages including an adjacent page.

Matsuda in view of Knox does not disclose expressly that the absorbency of the back and adjacent sides is approximated using the relationship: $A_{23}^{e}(x,y) \equiv \left[1 - T_2^2(x,y)T_3^s(x,y)\right]$ where $T_3^s(x,y)$ and $T_2^2(x,y)$ are obtained from the scanned data as $T_3^s(x,y) \equiv R_3^s(x,y) / R_p^w$ and $T_2^2(x,y) \approx R_2^2(x,y) / R_p^w$.

Balanis discloses the relationship between reflection and transmission of electromagnetic fields (page 222, figure 5-17 and page 223, equation 5-69c of Balanis), which is based on the fact that the fraction of the reflected field (Γ_{12}) plus the fraction of the transmitted field (T_{21}) are equal to one. Since the back and adjacent sides are in direct physical contact with one another, the reflection of the two pages together can be written as $\Gamma_{eq}(x,y) = \Gamma_3^s(x,y)\Gamma_2^2(x,y)$ where Γ_{eq} is the equivalent reflectance of the back and adjacent sides. Given the general

relationship Γ=1-T, the absorbency of the back and adjacent sides can be expressed by the equation $A_{23}^{e}(x,y) \equiv \left[1 - T_2^2(x,y)T_3^s(x,y)\right]$ since the absorbency of the back and the adjacent sides is a measure of how much shows through to the front side. A measure of the amount that shows through would inherently be a measure of the reflectance from the back and adjacent sides.

Matsuda in view of Knox is combinable with Balanis because they are from the same field of endeavor, namely the calculation of reflection data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the concepts of electromagnetic reflection and transmission for the image data of the back and adjacent sides. The motivation for doing so would have been that the reflections from the back and adjacent pages are significant when correcting for images on a book reader (figure 5-20 and page 230, lines 1-4 of Balanis). Therefore, it would have been obvious to combine Balanis with Matsuda in view of Knox.

Matsuda in view of Knox and Balanis does not disclose expressly that $T_3^s(x,y)$ and $T_2^2(x,y)$ are obtained from the scanned data as $T_3^s(x,y) \equiv R_3^s(x,y) / R_p^w$ and $T_2^2(x,y) \approx R_2^2(x,y) / R_p^w$.

Numakura discloses a relationship for normalized reflectance ($T=I/I_0$) (column 9, lines 47-54 of Numakura). $R_3^s(x,y)$ and $R_2^2(x,y)$ corresponds to I since both are the reflected light intensity. $T_3^s(x,y)$ and $T_2^2(x,y)$ are the corresponding normalized reflectances. R_p^w is the reference reflectance value and therefore corresponds to the value I_0.

Matsuda in view of Knox and Balanis is combinable with Numakura because they are from the same field of endeavor,

namely the computation of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the relationship taught by Numakura to determine the normalized reflectance of the back and adjacent sides. The motivation for doing so would have been that said relationship is needed in determining the density of the image data (column 9, lines 47-50 of Numakura). Therefore, it would have been obvious to combine Numakura with Matsuda in view of Knox and Balanis to obtain the invention as specified in claims 10 and 20.

Regarding claim 19: Matsuda discloses scanning the density of the front side (column 5, lines 4-9 of Matsuda).

Matsuda does not disclose expressly that the normalized reflectance of the back side image is determined by the show-through image information compensation device using the relationship: $T_3^s(x,y) \equiv R_3^s(x,y) / R_p^w$.

Knox discloses determining the reflectance of the back side image (column 5, line 66 to column 6, line 3 of Knox). When a document is scanned in by a scanner, the reflectance is measured by the CCD or other such device.

Matsuda and Knox are combinable because they are from the same field of endeavor, namely the control and correction of scanned image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan the back side of the document for reflectance data. The motivation for doing so would have been to correct for the existence of show-through data (column 5, lines 59-61 of Knox). Therefore, it would have been obvious to combine Knox with Matsuda.

Matsuda in view of Knox and Balanis does not disclose expressly that the normalized reflectance of the back side image is determined by the show-through image information compensation device using the relationship: $T_3^s(x,y) \equiv R_3^s(x,y) / R_p^w$.

Numakura discloses a relationship for normalized reflectance ($T=I/I_0$) (column 9, lines 47-54 of Numakura). $R_3^s(x,y)$ corresponds to I since both are the reflected light intensity and $T_3^s(x,y)$ is the corresponding normalized reflectance. R_p^w is the reference reflectance value and therefore corresponds to the value I_0.

Matsuda in view of Knox and Balanis is combinable with Numakura because they are from the same field of endeavor, namely the computation of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the relationship taught by Numakura to determine the normalized reflectance of the back side. The motivation for doing so would have been that said relationship is needed in determining the density of the image data (column 9, lines 47-50 of Numakura). Therefore, it would have been obvious to combine Numakura with Matsuda in view of Knox and Balanis to obtain the invention as specified in claim 19.

6. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Matsuda (US Patent 5,677,776) in view of Knox (US Patent 5,646,744), Balanis (*Advanced Engineering Electromagnetics*, by Constantine A. Balanis, John Wiley & Sons, copyright 1989), Bilgen ("Restoration of Noisy Images Blurred by a Random Point Spread Function", by Mehmet Bilgen and Hsien-Sen Hung, *IEEE International Symposium on Circuits and Systems*, 1-3

May 1990, volume 1, pages 759-762) and Numakura (US Patent 5,371,616).

Regarding claim 18: Matsuda discloses scanning the density of the front side (column 5, lines 4-9 of Matsuda).

Matsuda in view of Knox, Balanis and Bilgen does not disclose expressly that said show-through image compensation device determines the scanned density by determining a logarithm of the ratio of the received image data of a region having an image on the image bearing substrate and received image data of a region having no image on the image bearing substrate.

Numakura discloses determining a logarithm of the ratio of the received image data of a region having an image on the image bearing substrate (I) and received image data of a region having no image on the image bearing substrate (I_0) (column 9, lines 44-53 of Numakura). In order for the reference light intensity value (I_0) to be the same as the incident light intensity, it is inherent that there can be no image on the image bearing substrate.

Matsuda in view of Knox, Balanis and Bilgen is combinable with Numakura because they are from the same field of endeavor, namely the computation of image data. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the relationship taught by Numakura to determine the scanned density data. The motivation for doing so would have been that said determination is needed for the purpose of halftoning the image data (column 9, lines 41-43 of Numakura). Therefore, it would have been obvious to combine Numakura with Matsuda in view of Knox, Balanis and Bilgen to obtain the invention as specified in claim 18.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A Thompson whose telephone number is 703-305-6329. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K Moore can be reached on 703-308-7452. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

James A. Thompson
Examiner
Art Unit 2624

JAT
29 November 2004

THOMAS D.
[redacted] LEE
PRIMARY EXAMINER